

# Exhibit A

Excerpts of Final Environmental Impact Statement



# Columbia River System Operations Final Environmental Impact Statement July 2020

**Co-lead Agencies:**

**U.S. Army Corps of Engineers – Northwestern Division**

**Bureau of Reclamation – Columbia-Pacific Northwest Region**

**Bonneville Power Administration (DOE/EIS-0529)**



**US Army Corps  
of Engineers®**



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of their generating capacity and provide more flexibility to generate hydropower to meet demand. Removing the limitation would allow more water to pass through the turbines during periods of high flow, potentially reducing TDG levels in the river. This measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River power system.

**Zero generation operations may occur on lower Snake River projects November through February**

**This measure will be referred to as “Zero Generation Operations” throughout the remainder of this EIS.** This measure would allow the lower Snake River projects to cease hydropower generation when there is little demand, unless limited by grid stability requirements. Currently, these projects are allowed to operate at zero generation mid-December through mid-February. This measure would extend that period to begin in September and extend through March. This would allow operators to save water in low-demand periods to use during high-demand periods in order to meet demand for hydropower. This measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River power system.

**Sliding Scale at Libby and Hungry Horse**

This measure is the same as described in MO1. This measure would contribute to meeting objective 3 to improve resident fish survival and spawning success at CRS projects.

**2.4.5 Multiple Objective Alternative 3**

MO3 was developed to integrate actions for water management flexibility, hydropower production, and water supply with measures that would breach the four lower Snake River dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor). In addition to breaching these four projects, MO3 differs from the other alternatives by carrying out a juvenile fish passage spill operation that sets flow through the spillways up to a target of no more than 120 percent TDG in the tailrace of the four lower Columbia River projects (McNary, John Day, The Dalles, and Bonneville). The alternative also proposes an earlier end to summer juvenile fish passage spill operations than the No Action Alternative. Instead, flows would transition to increased hydropower production when low numbers of juvenile fish are anticipated.

Structural measures in this alternative include breaching the four lower Snake River dams by removing the earthen embankment at each dam location, resulting in a controlled drawdown.

Operational measures in MO3 are intended to improve juvenile fish travel times, improve conditions for resident fish in the upper basin, increase hydropower generation flexibility, provide more flexibility to water managers, and provide additional water supply.

A brief description of the measures contained in MO3 is listed in Table 2-7 and the following paragraphs.

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**Table 2-7. Measures of Multiple Objective Alternative 3**

<b>Measure Descriptions</b>	<b>Abbreviated Measure Name</b>
<b>Structural Measures</b>	
Construct additional powerhouse and/or spill surface passage routes at McNary Dam	Additional Powerhouse Surface Passage
Cease installation of fish screens at McNary Dam and John Day	Fewer Fish Screens
Upgrade spillway weirs to ASWs	Upgrade to Adjustable Spillway Weirs
Modify the upper ladder serpentine flow control ladder sections at Bonneville Dam	Modify Bonneville Ladder Serpentine Weir
Expand network of LPSs to bypass impediments	Lamprey Passage Structures
Modify turbine cooling water strainer systems to safely exclude Pacific lamprey	Turbine Strainer Lamprey Exclusion
Modify turbine intake bypass screens that cause juvenile lamprey impingement	Bypass Screen Modifications for Lamprey
Modify existing fish ladders, incorporating lamprey passage features and criteria	Lamprey Passage Ladder Modifications
Install improved fish passage turbines at John Day	Improved Fish Passage Turbines
<i>Dam Breach</i>	
Remove earthen embankments and adjacent structures, as required, at each lower Snake River dam	Breach Snake Embankments
Modify equipment and infrastructure to adjust to drawdown conditions at each lower Snake River dam	Lower Snake Infrastructure Drawdown
<b>Operational Measures</b>	
<i>Dam Breach</i>	
Develop procedures to operate existing equipment during reservoir drawdown	Drawdown Operating Procedures
Develop contingency plans to address unexpected issues with drawdown operations	Drawdown Contingency Plans
<i>Fish Passage</i>	
Limit fish passage spill to 120 percent TDG at McNary, John Day, The Dalles, and Bonneville Dams	Spring Spill to 120% TDG
Reduce the duration of summer juvenile fish passage spill	Reduced Summer Spill
Allow contingency reserves to be carried within juvenile fish passage spill	Contingency Reserves Within Juvenile Fish Passage Spill
<i>Water Management</i>	
Modify Libby draft and refill operations when water supply forecast is 6.9 Maf or less	Modified Draft at Libby
Eliminate end-of-December variable draft at Libby and replace with single draft target	December Libby Target Elevation
Update the upstream Storage Corrections Method as applied to the Grand Coulee SRD with flat spot retained	Update System FRM Calculation
Decrease the Grand Coulee Dam draft rate used in planning drawdown	Planned Draft Rate at Grand Coulee

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Measure Descriptions	Abbreviated Measure Name
Operational constraints for ongoing Grand Coulee maintenance of power plants	Grand Coulee Maintenance Operations
<i>Water Supply</i>	
Increase volume of water pumped from Lake Roosevelt during annual irrigation season	Lake Roosevelt Additional Water Supply
Increase water managers' flexibility to store and release water from Hungry Horse Reservoir	Hungry Horse Additional Water Supply
Increase water diversion from the Columbia River for the Chief Joseph Dam Project	Chief Joseph Dam Project Additional Water Supply
<i>Hydropower</i>	
Ramping rate limitations at all projects will be defined only for safety or engineering	Ramping Rates for Safety
At John Day, allow project to operate up to full pool except as needed for FRM	John Day Full Pool
Operate turbines within and above 1 percent peak efficiency in juvenile fish passage season	Above 1% Turbine Operations
<i>Other Operational</i>	
Implement sliding scale summer draft at Libby and Hungry Horse Dams	Sliding Scale at Libby and Hungry Horse

#### **2.4.5.1 Multiple Objective Alternative 3 Description of Measures**

##### **STRUCTURAL MEASURES**

##### **Remove earthen embankments and adjacent structures, as required, at each lower Snake River dam**

**This measure will be referred to as “Breach Snake Embankments” throughout the remainder of this EIS.** This measure would breach the lower Snake River dams. The demolition would remove the earthen embankments, abutments, and portions of existing structures at the dams to eliminate the reservoirs behind the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Projects. In order to minimize impacts to migrating salmon and ensure safety, the removal of the embankments would be conducted in two phases during the low water period in the river. Drawdown would begin in August, with the removal of structures during October, months when few ESA-listed salmon would be present in the Snake River. To do this, the north embankments at the Lower Granite and Little Goose Projects would be removed the first year, and the south embankment at Lower Monumental and north embankment at Ice Harbor would be removed the second year. The co-lead agencies would implement a controlled drawdown, at a rate of 2 feet per day, beginning in August and continuing through December, in order to safely evacuate the reservoir and minimize damages to infrastructure (highways, bridges, railroads) adjacent to the reservoirs. In-water structures such as anchored concrete blocks would be installed at Ice Harbor to produce resting pools and hydraulic conditions needed for fish passage. This measure was developed to contribute to meeting objective 1 for improvements to ESA-listed juvenile salmonid rearing, passage, and survival.

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### **Modify equipment and infrastructure to adjust to drawdown conditions at each lower Snake River dam**

**This measure will be referred to as “Lower Snake Infrastructure Drawdown” throughout the remainder of this EIS.** In order to implement breaching, the reservoirs would be drawn down to spillway elevations. In order to evacuate the reservoirs below this level, three turbines at each of the four lower Snake River dams would be modified so that they could be used as low-level water outlets to support a controlled drawdown of the reservoirs. The turbines would be modified to operate over a range of low head conditions, requiring modification to the cooling water systems, and removal of the turbine blades. This would allow maximum discharge of water through the turbine passages at low head. These actions would be taken several months in advance of initiation of drawdown. This measure was developed to contribute to meeting objective 1 for improvements to ESA-listed juvenile salmonid rearing, passage, and survival.

### **Additional Powerhouse Surface Passage**

This measure is the same as described in MO1, but without inclusion of the Ice Harbor Project on the lower Snake River. This measure would contribute to meeting objective 1 to improve passage for ESA-listed juvenile anadromous fish.

### **Fewer Fish Screens**

This measure is the same as described in MO2, but without inclusion of the Ice Harbor Project on the lower Snake River. Removal of fish screens would make hydropower production more efficient. Thus, this measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply.

### **Upgrade to Adjustable Spillway Weirs**

This measure is the same as described in MO1 but applies only to the lower Columbia River projects and does not include the lower Snake River projects. This measure was developed to contribute to meeting objective 1 for improvements to ESA-listed juvenile salmonid rearing, passage, and survival.

### **Modify Bonneville Ladder Serpentine Weir**

This measure is the same as described in MO1. This measure is intended to benefit adult fish passage and would contribute to meeting objective 2 for adult ESA-listed anadromous fish.

### **Lamprey Passage Structures**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.



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### **Turbine Strainer Lamprey Exclusion**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

### **Bypass Screen Modifications for Lamprey**

This measure is the same as described in MO1 but would only be implemented at McNary. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

### **Lamprey Passage Ladder Modifications**

This measure is the same as described in MO1 but would not be implemented at the lower Snake River projects. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

### **Improved Fish Passage Turbines**

This measure is the same as described in MO1. This measure would contribute to meeting objectives 4 and 5 by installing new turbines for an efficient and reliable power supply that minimizes greenhouse gas emissions. Because the turbines are designed to minimize negative impacts to fish passing through the powerhouse, it would also contribute to meeting objective 1, which strives to improve passage and survival for ESA juvenile anadromous fish.

## **OPERATIONAL MEASURES**

### **Develop procedures to operate existing equipment during reservoir drawdown**

**This measure will be referred to as “Drawdown Operating Procedures” throughout the remainder of this EIS.** This measure would be implemented in conjunction with the structural measures described above. Under this measure, equipment at the dams to be used for drawdown would be tested and calibrated to establish operational limits. Engineers, and powerhouse and transmission operators would establish manual operations and procedures using the modified equipment to facilitate a controlled and safe reservoir evacuation to support dam breaching. This measure was developed to contribute to meeting objective 1 for improvements to ESA-listed juvenile salmonid rearing, passage, and survival.

### **Develop contingency plans to address unexpected issues with drawdown operations**

**This measure will be referred to as “Drawdown Contingency Plans” throughout the remainder of this EIS.** Corps staff that operate the dams would develop plans for unexpected operations or emergency shutdown during reservoir drawdown. To address the risks of breaching such large dams, training would be provided to dam and transmission system operators to implement emergency actions during unanticipated circumstances to ensure the safety of the general public and construction and dam personnel during reservoir drawdown. This measure

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was developed to contribute to meeting objective 1 for improvements to ESA-listed juvenile salmonid rearing, passage, and survival.

### **Limit fish passage spill to 120 percent TDG at McNary, John Day, The Dalles, and Bonneville Dams**

**This measure will be referred to as “Spring Spill to 120 Percent TDG” throughout the remainder of this EIS.** This measure would modify spring juvenile fish passage spill to allow spill up to 120 percent tailrace gas cap. Juvenile fish passage spill to 120 percent TDG would be implemented annually at the McNary, John Day, The Dalles, and Bonneville Projects from April 10 to June 15. McNary, John Day, and The Dalles would spill to 120 percent in the tailrace, while Bonneville would spill to 120 percent in the tailrace not to exceed a 150-kcfs spill constraint. The juvenile fish spill volumes at each project are described in Table 2-8. This measure is intended to contribute to meeting objective 1 to improve the passage and survival of juvenile ESA-listed salmonids.

**Table 2-8. Juvenile Fish Passage Spill Measure for Multiple Objective Alternative 3**

<b>Location</b>	<b>Spill Regime</b>
McNary	120% tailrace Spill Cap <sup>1/</sup>
John Day	120% tailrace Spill Cap <sup>1/</sup>
The Dalles	120% tailrace Spill Cap <sup>1/</sup>
Bonneville	120% tailrace Spill Cap <sup>1/</sup> , not to exceed 150 kcfs spill

<sup>1/</sup> The term “spill cap” refers to the maximum spill level at each project that is estimated to meet, but not exceed, the gas cap in the tailrace unless the spill cap is constrained (e.g., 150 kcfs maximum spill for Bonneville Dam). In this measure, spill caps will be set to meet, but not exceed, the gas cap of 120% TDG as measured at the tailrace fixed monitoring stations. This gas cap is consistent with the current Oregon TDG water quality standard modification and with Washington State’s current short-term modification to its TDG water quality standard (2019), which removed the 115% TDG criteria.

### **Reduce the duration of summer juvenile fish passage spill**

**This measure will be referred to as “Reduced Summer Spill” throughout the remainder of this EIS.** This measure would reduce the period of fish passage spill in the summer, ending all summer spill operations at midnight July 31 at McNary, John Day, The Dalles, and Bonneville Dams to allow for an increase in hydropower production during periods when low numbers of juvenile fish are migrating. This measure would contribute to meeting objective 4, and is intended to provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River power system.

### **Ramping Rates for Safety**

This measure is the same as described in MO2. This measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply, by allowing additional flexibility to generate hydropower.

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**John Day Full Pool**

This measure is the same as described in MO2. By providing additional operating flexibility this measure would continue to meet objective 4 for an adequate, efficient, economical, and reliable power supply.

**Operate turbines within and above 1 percent peak efficiency during juvenile fish passage season**

**This measure will be referred to as “Above 1 Percent Turbine Operations” throughout the remainder of this EIS.** This measure would lift the requirement to operate hydropower turbines only within a 1 percent peak efficiency during the fish passage season at McNary, John Day, The Dalles, and Bonneville Dams. This would allow turbine operation within and above the current 1 percent peak efficiency limit to increase flexibility for hydropower generation to meet demand during high flow periods. This measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River power system.

**Sliding Scale at Libby and Hungry Horse**

This measure is the same as described in MO1. This measure would contribute to meeting objective 3 to improve resident fish survival and spawning success at CRS projects.

**Contingency Reserves Within Juvenile Fish Passage Spill**

This measure is the same as described in MO1. This measure would contribute to meeting objective 4 to provide an adequate, efficient, and reliable power supply.

**Modified Draft at Libby**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

**December Libby Target Elevation**

This measure is the same as described in MO1, but with a target elevation of 2,400 feet NGVD29. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

**Update System FRM Calculation**

This measure is the same as described in MO1, except that the SRD maintains what is known as the “flat spot” from the No Action Alternative. The flat spot is a range of water supply conditions that does not require additional draft, but rather requires a consistent draft (“flat”)

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of 1,222.7 feet NGVD29 over those conditions. This slight adjustment to the flood risk draft elevation reduces impacts to water supply operations. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

#### **Planned Draft Rate at Grand Coulee**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

#### **Grand Coulee Maintenance Operations**

This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions. This measure would also contribute to meeting objective 4 to provide a reliable power supply by supporting maintenance of the turbines at Grand Coulee.

#### **Lake Roosevelt Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **Hungry Horse Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **Chief Joseph Dam Project Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **2.4.6 Multiple Objective Alternative 4**

MO4 was developed to examine an additional combination of measures to benefit ESA-listed fish integrated with measures for water management flexibility, hydropower production, and additional water supply. The additional combination of fish measures that differ from the other alternatives include proposing spillway weir notch inserts, changes to the juvenile fish transportation operations, the highest spill target in the range considered in this EIS. Annually drawing down the lower Snake River and Columbia River reservoirs to their minimum operating pools, a measure for establishment of riparian vegetation, dry-year augmentation of spring flow

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with water stored in upper basin reservoirs, and increased powerhouse surface passage for kelt and overshoots.

The structural measures in this alternative are primarily focused on improving passage conditions for ESA-listed salmonids and Pacific lamprey. The inclusion of spillway weir notch inserts is the only structural measure difference from the other action alternatives. The operational measures are focused on making improvements and providing flexibility across authorized project purposes. In MO4, the juvenile fish transport program is proposed to operate only in the spring and fall, while juvenile fish passage spill is set to a target of no more than 125 percent TDG during the spring and summer spill season. The alternative also contains a measure for flows from the Libby Project targeted for downstream riparian vegetation establishment that is intended to improve conditions for ESA-listed resident fish, bull trout, and Kootenai River white sturgeon in the upper Columbia River Basin.

A brief description of the measures contained in MO4 is listed in Table 2-9 and the following paragraphs.

**Table 2-9. Measures of Multiple Objective Alternative 4**

Measure Descriptions	Abbreviated Measure Name
<b>Structural Measures</b>	
Construct additional powerhouse surface passage routes to meet system-wide PITPH target	Additional Powerhouse Surface Passage
Improve adult ladder passage through modification of adult trap at Lower Granite Dam	Lower Granite Trap Modifications
Install pumping systems to provide deeper, cooler water in adult fish ladders at Lower Monumental and Ice Harbor Dams	Lower Snake Ladder Pumps
Install improved fish passage turbines at John Day	Improved Fish Passage Turbines
Expand network of LPSs to bypass impediments	Lamprey Passage Structures
Modify turbine intake bypass screens that cause juvenile lamprey impingement	Bypass Screen Modifications for Lamprey
Modify existing fish ladders, incorporating lamprey passage features and criteria	Lamprey Passage Ladder Modifications
Addition of spillway weir notch gate inserts	Spillway Weir Notch Inserts
Modify turbine cooling water strainer systems to safely exclude Pacific lamprey	Turbine Strainer Lamprey Exclusion
<b>Operational Measures</b>	
<i>Fish Passage</i>	
Spill through surface passage structures for steelhead overshoots, overwintering steelhead, and kelt	Spill for Adult Steelhead
Set juvenile fish passage spill to not exceed 125 percent TDG	Spill to 125% TDG
Allow contingency reserves to be carried within juvenile fish passage spill	Contingency Reserves Within Juvenile Fish Passage Spill
Implement juvenile fish transportation during spring and fall periods at Lower Granite, Little Goose, and Lower Monumental Dams	Spring & Fall Transport
Cease juvenile transport during portions of summer spill period at Lower Granite, Little Goose, and Lower Monumental Dams	No Summer Transport

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<b>Measure Descriptions</b>	<b>Abbreviated Measure Name</b>
<i>Water Management</i>	
Modify Libby draft and refill operations when water supply forecast is 6.9 Maf or less	Modified Draft at Libby
Eliminate end-of-December variable draft at Libby and replace with single draft target	December Libby Target Elevation
Update the upstream Storage Corrections Method as applied to the Grand Coulee SRD	Update System FRM Calculation
Decrease the Grand Coulee Dam draft rate used in planning drawdown	Planned Draft Rate at Grand Coulee
Operational constraints for ongoing Grand Coulee maintenance of power plants and spillways	Grand Coulee Maintenance Operations
Develop draft requirements/assessment approach to protect against rain-induced flooding	Winter System FRM Space
<i>Water Supply</i>	
Increase volume of water pumped from Lake Roosevelt during annual irrigation season	Lake Roosevelt Additional Water Supply
Increase water managers' flexibility to store and release water from Hungry Horse Reservoir	Hungry Horse Additional Water Supply
Increase water diversion from the Columbia River for the Chief Joseph Dam Project	Chief Joseph Dam Project Additional Water Supply
Operate turbines within and above 1 percent peak efficiency in juvenile fish passage season	Above 1% Turbine Operations
<i>Other Operational Measures</i>	
Strive to hold minimum 220 kcfs spring flow/200 kcfs summer flow at McNary Dam using upstream storage	McNary Flow Objective
Reservoir drawdown to Minimum Operating Pool to reduce outmigration travel time	Drawdown to MOP
Implement sliding scale summer draft at Libby and Hungry Horse	Sliding Scale at Libby and Hungry Horse
Support establishment of vegetation at Libby Dam by limiting Bonners Ferry stage height November through March	Winter Stage for Riparian

Note: PITPH = probability of passing powerhouses.

#### **2.4.6.1 Multiple Objective Alternative 4 Description of Measures**

##### **STRUCTURAL MEASURES**

##### **Additional Powerhouse Surface Passage**

This measure is the same as described in MO1, but under MO4, the additional powerhouse surface passage route would be used to measure PITPH. As stated in the May 13, 2019, Fish Passage Center Memorandum, "PITPH is an index that describes the probability that an average juvenile fish will experience powerhouse passage under specific project operations. PITPH is an index used to characterize the effects of spill in CSS analyses. CSS analyses have shown that the probability of passing powerhouses (PITPH) influences juvenile travel time, juvenile survival,

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and smolt-to-adult return rates” (Fish Passage Center [FPC] 2019). This measure would contribute to meeting objective 1 to improve passage for ESA-listed juvenile anadromous fish.

#### **Lower Granite Trap Modifications**

This measure is the same as described in MO1. This measure would contribute to meeting objective 2 to improve passage for adult ESA-listed anadromous fish.

#### **Lower Snake Ladder Pumps**

This measure is the same as described in MO1. This measure would contribute to meeting objective 2 to improve adult ESA-listed anadromous fish migration.

#### **Improved Fish Passage Turbines**

This measure is the same as described in MO1. This measure would contribute to meeting objectives 4 and 5 by installing new turbines for an efficient and reliable power supply that minimizes greenhouse gas emissions. Because the turbines are designed to minimize negative impacts to fish passing through the powerhouse, it would also contribute to meeting objective 1, which strives to improve passage and survival for ESA juvenile anadromous fish.

#### **Lamprey Passage Structures**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

#### **Bypass Screen Modifications for Lamprey**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

#### **Lamprey Passage Ladder Modifications**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

#### **Turbine Strainer Lamprey Exclusion**

This measure is the same as described in MO1. This measure would contribute to meeting the objective to improve conditions for Pacific lamprey.

#### **Add spillway weir notch gate inserts**

**This measure will be referred to as “Spillway Weir Notch Inserts” throughout the remainder of this EIS.** Modify existing spillway weirs at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, and John Day Dams. A notch gate would be installed in one spillway weir at each dam to create a smaller opening in the weir and enable reduced spill flow velocities. The



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notched weirs would be operated October 1 to November 31 at all dams. This measure would contribute to meeting objective 1 and is intended to improve the passage and survival of ESA-listed juvenile anadromous fish.

## **OPERATIONAL MEASURES**

### **Spill through surface passage structures for steelhead overshoots, overwintering steelhead and kelt**

**This measure will be referred to as “Spill for Adult Steelhead” throughout the remainder of this EIS.** Implementation of this measure would require modification of the spillway weirs as described above for the Spillway Weir Notch Inserts measure to facilitate downstream passage of adult salmon, steelhead, and kelt. Flows would be directed through the weirs at the Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, and John Day Projects from October 1 to November 31. The measure is intended to increase adult salmon and steelhead survival by decreasing passage mortality of adult steelhead. This measure would contribute to meeting objective 2, intended to benefit adult ESA-listed anadromous fish.

### **Set juvenile fish passage spill to not exceed 125 percent TDG**

**This measure will be referred to as “Spill to 125 Percent TDG” throughout the remainder of this EIS.** This measure would set the target for juvenile fish passage spill up to 125 percent TDG, as measured in the tailrace, at the four lower Snake River and four lower Columbia River projects. Juvenile fish passage spill to this level would be dependent upon availability of sufficient flow to meet minimum generation requirements for hydropower. Upstream storage reservoirs would not be drafted specifically to reach 125 percent TDG spill levels. This juvenile fish passage spill regime would be implemented March 1 to August 31 at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville Dams. This measure is intended to improve passage for juvenile ESA-listed salmonids, and as such, would contribute to meeting objective 1.

### **Allow contingency reserves to be carried within juvenile fish passage spill**

**This measure will be referred to as “Contingency Reserves Within Juvenile Fish Passage Spill” throughout the remainder of this EIS.** This measure is the same as described in MO1. This measure would contribute to meeting objective 4 to provide an adequate, efficient, and reliable power supply.

### **Implement juvenile fish transportation during spring and fall periods at Lower Granite, Little Goose, and Lower Monumental Dams**

**This measure will be referred to as “Spring & Fall Transport” throughout the remainder of this EIS.** Juvenile fish transportation on barges and trucks would be implemented in two timeframes, April 25 to June 14, and August 16 to November 15, rather than transport beginning no later than May 1 through the migration season. During these two transport

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seasons, all juvenile salmonids that enter the juvenile fish bypass systems at Lower Granite, Little Goose, and Lower Monumental Dams would be collected and transported to a location downstream of Bonneville Dam for release. This measure would contribute to meeting objective 1 to improve passage and survival of juvenile ESA-listed salmonids.

**Cease juvenile transport during portions of summer spill period at Lower Granite, Little Goose, and Lower Monumental Dams**

**This measure will be referred to as “No Summer Transport” throughout the remainder of this EIS.** The juvenile transport program at Lower Granite, Little Goose, and Lower Monumental Dams would be suspended during the full summer timeframe (June 15 to August 15). Instead of collection for transport, all juvenile fish entering the fish bypasses at these projects would be returned to the river to migrate during the June 15 to August 15 window. This measure is a variation of the current and proposed transport program, which is intended to improve passage and survival of juvenile ESA-listed salmonids. As such, it would contribute to meeting objective 1.

**Modified Draft at Libby**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions

**December Libby Target Elevation**

This measure is the same as described in MO1, with a target elevation of 2,420 feet NGVD29. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

**Update System FRM Calculation**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

**Planned Draft Rate at Grand Coulee**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

**Grand Coulee Maintenance Operations**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable

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water management strategies in order to be responsive to changing conditions. This measure would also contribute to meeting objective 4 to provide a reliable power supply by supporting maintenance of the turbines at Grand Coulee.

#### **Winter System FRM Space**

This measure is the same as described in MO1. This measure was developed to contribute to meeting objective 6, which would maximize operating flexibility by implementing adaptable water management strategies in order to be responsive to changing conditions.

#### **Lake Roosevelt Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **Hungry Horse Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **Chief Joseph Dam Project Additional Water Supply**

This measure is the same as described in MO1. This measure would contribute to meeting objective 7 to meet existing water supply obligations and provide for additional authorized regional water supply.

#### **Above 1 Percent Turbine Operations**

This measure is the same as described in MO3, but would include the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Projects. This measure would contribute to meeting objective 4 to provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River power system.

#### **Strive to hold minimum 220 kcfs spring flow/200 kcfs summer flow at McNary using upstream storage**

**This measure will be referred to as “McNary Flow Target” throughout the remainder of this EIS.** This measure would augment flows in the lower Columbia River during the juvenile salmon outmigration period in low water years. The summer flow objective at McNary is supported by various flow augmentation measures in the No Action Alternative that would continue, however, this measure would provide additional flow augmentation. Even with this additional water, there is a limited amount of water available for flow augmentation and flow objectives are provided as a biological guideline. To meet this minimum flow objective for the lower Columbia River, up to 2.0 Maf of storage water from the Hungry Horse, Libby, Albeni Falls, and

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Grand Coulee Projects would be provided above that provided currently, in order to meet spring or summer flow objectives established for the McNary Project. Grand Coulee would be drafted from first to meet the flow objective, with no more than 40 kcfs being released in a single day and drafting the reservoir to no more than the minimum pool elevation. Then, Hungry Horse, Libby, and Albeni Falls reservoirs would be drafted to support the augmented flow target as well as to refill Grand Coulee's reservoir, but to a reduced refill elevation. Local resident fish operations in the upper basin, such as minimum flows for resident fish, would be maintained. In the event that all 2.0 Maf of water has not been used by June 15, then the remaining volume of water would be released to meet a reduced minimum flow objective of 200 kcfs at McNary through to July 31. This measure is not anticipated be implemented every year, but rather only when the system-wide April to August water supply forecast is below 87.5 Maf, the current 30-year average for the period 1981 to 2008, which will be updated after 2020. This measure is intended to benefit ESA-listed juvenile anadromous fish migration, and as such, would contribute to meeting objective 1.

#### **Reservoir drawdown to Minimum Operating Pool to reduce outmigration travel time**

**This measure will be referred to as "Drawdown to MOP" throughout the remainder of this EIS.** The lower Snake River and lower Columbia River projects would be operated at lower elevations to reduce travel times for juvenile fish out-migration while providing slightly increased operating range flexibility at the lower Snake River projects. These operations would be implemented at the lower Snake River projects from March 15 to August 15, and at the lower Columbia projects from March 25 to August 15. The projects would be drafted down to the following reservoir elevations (Table 2-10).

**Table 2-10. Drawdown to MOP Measure for Multiple Objective Alternative 4**

<b>Location</b>	<b>MO4 MOP Forebay Elevation</b>
Lower Granite	733.0 + 1.5 ft range
Little Goose	633.0 + 1.5 ft range
Lower Monumental	537 + 1.5 ft range
Ice Harbor	437 + 1.5 ft range
McNary	337.0 + 1.0 ft range
John Day	261.0 + 1.5 ft range
The Dalles	155.0 + 1.5 ft range
Bonneville	71.5 + 1.5 ft range

This measure is intended to benefit ESA-listed juvenile anadromous fish migration, and as such, would contribute to meeting objective 1.

#### **Sliding Scale at Libby and Hungry Horse**

This measure is the same as described in MO1. This measure would contribute to meeting objective 3 to improve resident fish survival and spawning success at CRS projects.

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## **7.5 DEVELOPMENT OF THE PREFERRED ALTERNATIVE**

Based on the information above, insights that resulted from the evaluation of the alternatives in Chapters 3, 4, 5, and 6, and information presented in Sections 7.1 through 7.3, the co-lead agencies developed the Preferred Alternative. The co-lead agencies worked together, with input from cooperating agencies, to identify a suite of measures to form a more balanced alternative.

Following the evaluation of the No Action and MO alternatives, the co-lead agencies selected a combination of measures for the Preferred Alternative based on how well the measures met the Purpose and Need Statement and study objectives, with consideration of environmental, economic, and social effects. Development of the Preferred Alternative allowed the co-lead agencies to refine several measures based on information learned during the modeling and evaluation process of the alternatives detailed in Chapter 3. In addition, new information on juvenile fish passage from the 2018 and 2019 operations for spring juvenile fish spill that benefit downstream migration of juvenile anadromous fish became available after the alternatives were developed. Using this information, the co-lead agencies modified the juvenile fish spill operation for the Preferred Alternative using the analysis from the range of spill levels evaluated in the MOs to attempt to provide a high potential benefit to salmon and steelhead through increased spill while avoiding many of the adverse effects to power generation and reliability associated with MO4. The primary method to accomplish this was a flexible spill operation that spills more for fish passage when power is less valuable and spills less when power is more valuable. The Preferred Alternative acknowledges the range of potential outcomes predicted by the models used to estimate effects to anadromous fish, including a study to evaluate the potential benefits and unintended consequences of a flexible spill operation.

All actions included in the Preferred Alternative are either: 1) carried forward from the No Action Alternative; 2) original measures or refined measures that were evaluated in MO1 to MO4; 3) added measures for lamprey passage (e.g., Closeable Floating Orifice Gates); or 4) measures identified as part of the associated CRS ESA consultation processes. This led to a Preferred Alternative that is a balanced approach that enables the co-lead agencies to meet the multiple congressionally authorized purposes of the system and requirements for fish and wildlife, including ESA-listed species. Following the initial development of the Preferred Alternative, it was shared with NMFS, USFWS, tribes, and cooperating agencies to solicit feedback.

## **7.6 DESCRIPTION OF THE PREFERRED ALTERNATIVE**

The Preferred Alternative includes a description of measures that would be implemented, in addition to components of the No Action Alternative, to operate the CRS to better meet the Purpose and Need Statement and objectives developed for the EIS. Operations, maintenance, and programs that were ongoing or planned as of 2016 are carried forward into the Preferred

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Alternative unless described otherwise. Ongoing operations and maintenance measures are described in more detail in Section 2.4.2.1.

As discussed in Chapter 2, the CRS is operated for a number of purposes: to reduce flood risk, generate hydropower, provide water for irrigation and water supply, to provide navigation, provide recreation, and to conserve fish and wildlife. These operations would continue unless modified by the Preferred Alternative below or under emergency operations described in Chapter 2. An operational emergency may be related to hydropower generation, transmission loss or interruption, fish emergencies related to equipment failure or other interruption of fish protection measures, and other unexpected circumstances such as fires, human health and safety concerns, or threats to dam infrastructure.

Consistent with Chapter 2, there are also research studies that may require special operations that differ from the routine operations otherwise described in the current fish passage plan (FPP). Variations in normal operations for research actions are coordinated with the Technical Management Team (TMT). Additionally, the co-lead agencies conduct monitoring activities. For example, under the Preferred Alternative, Bonneville is funding USFWS to conduct monitoring and surveys of plant and waterbird communities, including aquatic invasive species, and public outreach efforts during the implementation of the *Predator Disruption Operations* measure. This effort would evaluate whether there are effects to critical plant and waterbird communities and habitat along the reservoir and Umatilla National Wildlife Refuge.

Moreover, the Corps, Reclamation and Bonneville will continue to implement a maintenance program at each CRS project, consisting of routine inspection and maintenance of both power and non-power assets. The co-lead agencies conduct annual routine maintenance at all projects. Preventive and corrective maintenance coordinated and planned to occur at regular intervals is referred to as scheduled, or routine, maintenance. This type of routine maintenance would continue to be performed on all fish facilities, spillway components, navigation locks, generating units, and supporting systems to ensure project safety and reliability and to comply with North American Electric Reliability Corporation/Western Electricity Coordinating Council regulatory requirements (16 U.S.C. 824o[c]). Unplanned maintenance would continue under the Preferred Alternative. It is unscheduled and may occur any time a problem, unforeseen maintenance issue, or emergency requires a project feature (e.g., a generating unit), be taken offline in order to resolve the problem.

Additionally, ongoing actions are being carried forward from the No Action Alternative in Chapter 2, which includes measures committed to in the past to benefit ESA-listed fish species. These include actions under Bonneville's F&W Program, Corps' Columbia River Fish Mitigation Program and Reclamation's Tributary Habitat Program.

The Preferred Alternative includes actions to benefit ESA-listed fish, and these actions also benefit tribal interests and treaty resources. These actions include measures such as management of invasive species, improvements to fish and wildlife habitat, fish hatchery production, and management of avian and pinniped predators of ESA-listed salmonids. Most of the structural measures and some of the operational measures are intended to improve



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survival of anadromous salmon and steelhead, lamprey, and resident fish. These fish are important to tribes and the exercise of treaty-reserved rights, and traditional cultural practices including fishing, hunting, and gathering. In some locations, the Corps and Reclamation operate the dams to support tribal interests, primarily to benefit fish and wildlife and tribal fishing. Operations that support specific tribal interests are described in Section 2.4.2.1.

The rest of this section provides additional detail on the structural, operational, and mitigation measures included in the Preferred Alternative. They have been grouped into the following categories:

- 1) Structural and operational measures carried forward, modified, or added to the Preferred Alternative from those described in the MOs in Chapter 2
- 2) Mitigation measures to avoid, minimize, or offset adverse effects from the current suite of measures being proposed
- 3) Other measures to comply with Section 7(a)(2) of the ESA

#### **7.6.1 Measures Carried Forward, Modified, or Added from Alternatives in Chapter 2**

This section describes a complete list of structural and operational measures that are being carried forward, modified, or added to the Preferred Alternative from those described as part of the MOs in Chapter 2. These measures are listed in Table 7-2.

**Table 7-2. List of Measures that were Carried Forward, Modified, or Added to the Preferred Alternative from Alternatives in Chapter 2**

Description
<b>Structural Measures</b>
Hungry Horse Project Power Plant Modernization <sup>1/</sup>
Third Powerplant Overhaul Project
John W. Keys III Pump-Generating Plant Modernization Project
Grand Coulee G1 through G18 Plant Modernization Project
Lower Granite Trap Modifications
Lower Granite Juvenile Facility Bypass Improvements <sup>1/</sup>
Lower Granite Spillway Passive Integrated Transponder (PIT) Monitoring System <sup>1/</sup>
Little Goose Adjustable Spillway Weir Closure <sup>1/</sup>
Little Goose Adult Ladder Temperature Improvements <sup>1/</sup>
Little Goose Boat Barrier <sup>1/</sup>
Little Goose Trash Shear Boom Repair <sup>1/</sup>
Ice Harbor Turbines 1–3 Replacement and Generator Rewind <sup>1/</sup>
McNary Turbine Replacement <sup>1/</sup>
John Day Adult Passive Integrated Transponder Tag (PIT) Monitoring System <sup>1/</sup>
John Day Improved Fish Passage Turbines
Bonneville Gatewell Orifice Modifications <sup>1/</sup>



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<b>Description</b>
Bonneville Ladder Serpentine Weir Modifications
Closeable Floating Orifice Gates for Lamprey
Bypass Screen Modifications for Lamprey
Lamprey Passage Ladder Modifications
Turbine Strainer Lamprey Exclusion
Fewer Fish Screens
<b>Operational Measures</b>
Sliding Scale at Libby and Hungry Horse
Modified Draft at Libby
Planned Draft Rate at Grand Coulee
Grand Coulee Maintenance Operations
Update System FRM Calculation at Grand Coulee
Lake Roosevelt Additional Water Supply
Fall Operational Flexibility for Hydropower (Grand Coulee)
Slightly Deeper Draft for Hydropower (Dworshak)
Juvenile Fish Passage Spill Operations
Contingency Reserves within Juvenile Fish Passage Spill
Above 1% Turbine Operations
Increased Forebay Range Flexibility
Early Start Transport
Zero Generation Operations
Predator Disruption Operations
John Day Full Pool

1/ Carried forward from No Action Alternative.

## **7.6.2 Preferred Alternative Structural Measures**

The following structural measures are included in the Preferred Alternative.

### **7.6.2.1 Hungry Horse Project Power Plant Modernization**

This structural measure was carried forward from the No Action Alternative description in Chapter 2 with no changes. The power plant at Hungry Horse Project began an extensive modernization effort in Fiscal Year (FY) 2018 to bring the facilities to current industry standards. It will include the full overhaul or replacement of governors, exciters, fixed-wheel gates, and turbines; a generator rewind; overhaul of the selective withdrawal system; and recoating the penstocks. This power plant overhaul will occur over 1 year and will limit the powerplant availability to two units during the overhaul period. In addition, cranes that service the power plant will be refurbished or replaced, and the power plant will be brought up to modern fire protection standards. The full effort is expected to take 10 years to complete.